

Patent
USSN 09/541,351
Old Atty Docket 20060
New Atty Docket VMED-40004

Complete Listing of the Claims

1. (Amended) An RF coupled implantable medical system comprising:

a transmitting unit;

a receiving unit including an implantable, electrically operated, medical device, RF energy receiving means, RF signal transmitting means and a rechargeable battery;

said transmitting unit including a power source, RF energy transmitting means, RF signal receiving means and first control means coupled to said RF energy transmitting means and to said RF signal receiving means for controlling the amount of RF energy transmitted to said receiving unit thereby to conserve on the amount of power obtained from said power source; and,

second control means coupled to said RF energy receiving means, to said rechargeable battery, to said RF signal transmitting means and to said implantable medical device, for adjusting the charging current flowing into said rechargeable battery, as a function of (a) the charge level of said rechargeable battery, (b) selected charging rate, and (c) selected power supply for the implantable medical device .

2. (Original) The system of claim 1 wherein said receiving unit includes a titanium housing enclosing said RF energy receiving means, said RF signal transmitting means, said rechargeable battery and said second control means.

3. (Original) The system of claim 1 wherein said RF energy transmitting means of said transmitting unit is constructed to transmit energy at a frequency as

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low as 10 Hz and up to at least 20,000 Hz.

4. (Original) The system of claim 1 wherein said rechargeable battery has a temperature sensor which is mounted closely adjacent thereto and which is coupled via said RF signal transmitting means to said first control means of said transmitting unit whereby the level of transmitted RF energy can be reduced proportionally to the reduction in charging rate of the rechargeable battery in said receiving unit, in order to reduce the power consumption from said power source powering said transmitting unit.

5. (Amended) The system of claim 1 wherein said RF energy transmitting means of said transmitting unit includes mode selection means for recharging said rechargeable battery at a "fast" ~~(high energy)~~ high energy rate or at a "trickle" ~~(low to medium energy)~~ low to medium energy rate.

6. (Amended) The system of claim 1 wherein said transmitting unit include power source selection means for setting said receiving unit to obtain its operating power from (1) RF coupled energy (~~"RF only" mode~~) in a "RF only" mode, (2) said rechargeable battery (~~"battery only" mode~~) in a "battery only" mode or (3) automatically switch to "RF only " upon detection of said RF energy field, or "battery only " when said RF energy field is not detected (~~"combination" mode~~) in a "combination" mode.

7. (Original) The system of claim 6 wherein said receiving unit includes: (a) means for rectifying said RF energy into a relatively high D.C. voltage, (b) means for regulating said high D.C. voltage into a lower D.C. voltage, and (c) means for detecting the presence of said RF energy field, said receiving unit, when set to operate in said "RF coupled energy" mode, is operable to supply regulated electrical energy to said implantable device so long as said transmitting unit is located proximate to said receiving unit and said receiving unit is sensing

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transmitted RF energy.

8. (Original) The system of claim 6 wherein said receiving unit, when said transmitting unit is set to operate in said "battery only" mode, is operable, periodically, to supply electrical energy to said implantable device from said rechargeable power supply for a period of at least 24 hours.

9. (Original) The system of claim 6 wherein said receiving unit, when set to operate in said "combination" mode, is operable to supply regulated D.C. electrical energy to said implantable device, so long as said transmitting unit is located proximate to said receiving unit, and, separately, to "trickle charge" said rechargeable battery to maintain same fully charged.

10. (Original) The system of claim 1 wherein said first control means of said transmitting unit includes means for controlling the level of RF energy transfer from the transmitting unit to the receiving unit relative to one or more of one or more of the following parameters: (a) the charge level of said rechargeable battery, (b) selected charging rate, and (c) the selected power supply for said receiving unit.

11. (Original) The system of claim 1 wherein said receiving unit comprises means for measuring the charge level of said rechargeable battery and, upon sensing a fully charged battery, automatically up-links a coded signal which commands said transmitting unit to "stop" transmitting RF energy.

12. (Original) The system of claim 1 wherein said transmitting unit includes a visual display coupled to said first control means.

13. (Original) The system of claim 1 wherein said transmitting unit includes

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a keyboard coupled to said first control means.

14. (Original) The system of claim 13 wherein said keyboard includes keys to start and stop recharging of said rechargeable battery within the implantable medical device.

15. (Original) The system of claim 1 wherein said implanted medical device is a tissue stimulator.

16. (Original) The system of claim 1 wherein said implanted medical device is a drug delivery system.

17. (Original) The system of claim 1 wherein said implanted medical device is a cardiac pacemaker system.

18. (Original) The system of claim 1 wherein said implanted medical device is a cardioverter/defibrillator.

19. (Amended) The system of claim 1 wherein said transmitting unit includes a battery, whereby said transmitting unit is portable and not ~~dependant~~ dependent upon an a.c. power source.

20. (Original) The system of claim 19 wherein said battery can be a rechargeable battery or a non-rechargeable battery.

21. (Original) The system of claim 1 wherein said RF energy transmitting means of said transmitting unit includes mode selection means for setting said transmitting unit to operate in one of the following modes: "RF only", "battery only" or a "combination of both".

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22. (Original) The system of claim 21 wherein said RF energy transmitting means of said transmitting unit controls the amount of RF energy transmitted and,

(a) when said implanted receiving unit is set to operate in said "RF only" mode, said transmitted RF energy is automatically adjusted to the amount of RF energy required (i) to operate said implanted device and (ii) to maintain said rechargeable battery, which is powering said implanted device, in a fully charged state;

(b) when said implanted receiving unit is set to operate in said "battery only" mode, said transmitted RF energy is automatically adjusted to the amount of RF energy required (i) to operate said implanted device and (ii) to recharge quickly said rechargeable battery which is powering said implanted device; and,

(c) when said implanted receiving unit is set to operate in said "combination of both" mode, said receiving unit is set to switch automatically to either said "RF only" mode upon detecting said transmitted RF energy, or to said "battery only" mode upon detecting a loss of said transmitted RF energy.

23. (Original) An RF coupled implantable medical system comprising:
a transmitting unit;

a receiving unit including an implantable, electrically operated, medical device;

said transmitting unit including RF energy transmitting means, RF signal receiving means and first control means coupled to said RF energy transmitting means and to said RF signal receiving means for controlling the amount of RF

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27. (Original) The system of claim 23 wherein said receiving unit, when said transmitting unit is set to operate in said "combination" mode, is operable to supply electrical energy to said implantable device through a rectifier directly to said implanted medical device, so long as said transmitting unit is located proximate to said receiving unit, and, separately, to "trickle charge" said rechargeable power supply.

28. (Amended) An RF coupled implantable medical system comprising:

a transmitting unit;

a receiving unit including an implantable, electrically operated, medical device;

said transmitting unit including RF energy transmitting means, RF signal receiving means and first control means coupled to said RF energy transmitting means and to said RF signal receiving means for controlling the amount of RF energy transmitted to said receiving unit;

said receiving unit including RF energy receiving means, RF signal transmitting means, a rechargeable power supply coupled to said RF energy receiving means and control means for adjusting the charging current flowing into [said rechargeable battery coupled to] said rechargeable power supply [means], the current to said RF energy receiving means, the current to said RF signal transmitting means and [to] output signals from an output of said implanted medical device:[and,]

said receiving unit comprising means for measuring the charge level of said

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rechargeable [battery] power supply and, upon sensing a fully charged [battery] power supply, automatically up-linking a coded signal which commands said transmitting unit to["stop"] stop transmitting RF energy; and,

mode selection means for controlling the supply of power in one of several modes of operation selected from one of: a) simultaneously operate the implanted medical device and recharge the rechargeable power supply from the transmitted RF energy, b) operate the implanted medical device exclusively from the rechargeable power supply, c) operate the implanted medical device from the transmitted RF energy or d) operate the implanted device from both the rechargeable power supply and the transmitted RF energy.

29. (New) An RF coupled implantable medical system comprising:
a transmitting unit;

a receiving unit including an implantable, electrically operated, medical device, RF energy receiving means, and a rechargeable power supply;

said transmitting unit including a power source and an RF energy transmitting means;

said receiving unit including control means coupled to said rechargeable power supply and to said implantable medical device for adjusting the charging current flowing into said rechargeable power supply; and,

mode selection means for controlling the supply of power in one of several modes of operation selected from one of: a) simultaneously operate the implanted medical device and recharge the rechargeable power supply from the transmitted RF energy, b) operate the implanted medical device exclusively from the

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rechargeable power supply, c) operate the implanted medical device from the transmitted RF energy or d) operate the implanted device from both the rechargeable power supply and the transmitted RF energy.

Cancel claim 30.

31. (New) An RF coupled implantable medical system comprising:

a transmitting unit;

a receiving unit including an implantable, electrically operated, medical device, RF energy receiving means, and a rechargeable power supply;

said transmitting unit including a power source, RF energy transmitting means, and transmitting control means coupled to said RF energy transmitting means for controlling the amount of RF energy transmitted to said receiving unit thereby to conserve on the amount of power obtained from said power source;

said receiving unit including second control means coupled to said rechargeable power supply and to said implantable medical device for adjusting the charging current flowing into said rechargeable power supply; and,

mode selection means for controlling the supply of power in one of several modes of operation selected from one of: a) simultaneously operate the implanted medical device and recharge the rechargeable power supply from the transmitted RF energy, b) operate the implanted medical device exclusively from the rechargeable power supply, c) operate the implanted medical device from the transmitted RF energy or d) operate the implanted device from both the rechargeable power supply and the transmitted RF energy.

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32. (New) An RF coupled implantable medical system of claim 29 further comprising memory means coupled to said control means for storing information for controlling an output signal from said implantable medical device.

Cancel claim 33.

34. (New) An RF coupled implantable medical system of claim 31 further comprising memory means coupled to said second control means for storing information for controlling an output signal from said implantable medical device.